FORM PTO-1390 U S DEPARTMENT OF COMMERCE AND TRADEMARK OFFICE
(REV 10-95)

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371

ATTORNEY'S DOCKET NUMBER: HAS-008.01

U S APPLICATION NO. (If known, see 37 CFR 1.5): 09/700139

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/EP99/03312	(14/05/99) 14 May 1999	(15/05/98) 12 May 1998

TITLE OF INVENTION:
PANEL LOUDSPEAKER

APPLICANT(S) FOR DO/EO/US
Wolfgang BACHMANN, Gernhard KRUMP and Hans-Jürgen REGL

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1.	(X)			This is the FIRST submission of items concerning a filing under 35 U.S.C. 371.
2.	( )			This a SECOND or SUBSEQUENT submission of items concerning a filing under 35 U.S.C. 371.
3.	(X)			This express request to begin national examination procedures (35 U.S.C. 371(f) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(l).
4.	( )			A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5.	(X)			A copy of the International Application as filed (35 U.S.C. 371(c)(2)).
		a.	( )	is transmitted herewith (required only if not transmitted by the International Bureau).
		b.	(x)	has been transmitted by the International Bureau.
		c.	( )	is not required, as the application was filed in the United States Receiving Office (RO/US).
6.	(X)			A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7.	(X)			Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3)).
		a.	(X)	are transmitted herewith (required only if not transmitted by the International Bureau).
		b.	( )	has been transmitted by the International Bureau.
		c.	( )	have not been made; however, the time limit for making such amendments has NOT expired.
		d.	( )	have not been made and will not be made.
8.	(X)			A translation of the amendments to the claims and specification under PCT Article 19 (35 U.S.C. 371(c)(3)).
9.	( )			An executed oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10.	(X)			A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11. to 16. below concern document(s) or information included:

11.	( )	An information Disclosure Statement under 37 CFR 1.97 and 1.98.
12.	( )	An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13.	(X)	A FIRST preliminary amendment.
	( )	A SECOND or SUBSEQUENT preliminary amendment.
14.	( )	A substitute specification with amended claims.
15.	( )	A change of power of attorney and/or address letter.
16.	( )	Other items of information.
		( ) International Preliminary Examination Report (with translation)
		( ) PCT Request Form (with translation).
		(X) translator's certificate for items (6), (8) and (10)

Certificate of Express Mail

I hereby certify that the foregoing documents are being deposited with the United States Postal Service as Express Mail, postage prepaid, "Post Office to Addressee", in an envelope addressed to the Assistant Commissioner for Patents, Box PCT, Attn: DO/EO/US, Washington, D.C. 20231 on the date indicated below.

Robert King
Date of Deposit: November 9, 2000
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422 Rec'd PCT/PTO 09 NOV 2000

U.S. APPLICATION NO. (if known, see 37 CFR 1.5)	INTERNATIONAL APPLICATION NO	ATTORNEY'S DOCKET NUMBER
09/700139	PCT/EP99/03312	HAS-008.01

17.	(x)	The following fees are submitted:	CALCULATIONS PTO USE ONLY
BASIC NATIONAL FEE (37 CFR 1.492(a)(1)-(5)):			
		Neither international preliminary examination fee (37 CFR 1.482) ..... **$1000.00** Nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO.....	
		International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO $860.00	
		International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO..... **$710.00**	
		International preliminary examination fee paid to USPTO (37 CFR 1.482) but all claims did not satisfy provisions of PCT Article 331(1)-(4)..... **$740.00**	
		International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(1)-(4)..... **$100.00**	
		ENTER APPROPRIATE BASIC FEE AMOUNT =	$860.00
		Surcharge of **$130.00** for furnishing the oath or declaration later than ( ) 20 (x) 30 months from the earliest claimed priority date (37 CFR 1.492(e)).	$0

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE	
Total claims	8 - 20 =	0	X $18.00	$0
Independent claims	1 - 3 =	0	X $78.00	$0
MULTIPLE DEPENDENT CLAIM(S) (if applicable)			+ $260.00	$0
	TOTAL OF ABOVE CALCULATIONS =			$860.00
Reduction of 1/2 for filing by small entity, if applicable. Verified Small Entity Statement must also be filed (Note 37 CFR 1.9, 1.27, 1.28).				$0
	SUBTOTAL =			$0
Processing fee of **$130.00** for furnishing the English translation later than ( ) 20 ( ) 30 + months from the earliest claimed priority date (37 CFR 1.492(f)).				$0
	TOTAL NATIONAL FEE =			$0
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). **$40.00** per property. +				$0
	TOTAL FEES ENCLOSED =			$860.00
			Amount to be: refunded	$
$860.00			charged	$

a. (X) A check in the amount of $0 to cover the above fees is enclosed.

b. ( ) Please charge my Deposit Account No **06-1448**, in the amount of **$.00** to cover the above fees. A duplicate copy of this sheet is enclosed.

c. ( ) The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 06-1448

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:		
Patent Group **at Customer Number 25181** Foley, Hoag & Eliot LLP One Post Office Square Boston, MA 02109-2170		SIGNATURE Wolfgang Stutius, Reg. No. 40,256
		Date: November 9, 2000

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PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of		:		
	BACHMANN et al.	:		
Appln. No.	To be assigned	:	Art Unit:	To be assigned
Filed:	To be assigned	:	Examiner:	To be assigned
For:	PANEL LOUDSPEAKER	:	Atty Docket:	HAS-008.01

CERTIFICATE OF EXPRESS MAILING

I hereby certify that the foregoing documents are being deposited with the United States Postal Service as Express mail, postage prepaid, "Post Office to Addressee" in an envelope addressed to: Assistant Commissioner for Patents, Box PCT, Attn: DO/EO/US, Washington, DC 20231 on November 9, 2000.

Robert King
Express Mail Label No.: EL 408 392 913 US

PRELIMINARY AMENDMENT

Assistant Commissioner for Patents
Washington, DC 20231

Sir:

Prior to examination of the above-captioned application, please enter the following amendments.

It is not believed that extensions of time or fees for net addition of claims are required, beyond those which may otherwise be provided for in documents accompanying this paper. However, in the event that additional extensions of time are necessary, such extensions of time are hereby petitioned under 37 C.F.R. § 1.136(a), and any fees required for consideration of this paper are authorized to be charged in two originally-executed copies of an Amendment Transmittal Letter filed herewith.

IN THE SPECIFICATION:

On page 1, line 2, replace "Technical field" with – Field of the invention –

On page 1, line 5, replace "State of the art" with– Background of the invention –

On page 3, line 2, replace "Description" with – Summary –

On page 3, delete lines 3-4.

On page 3, line 15, delete ", according to claim 2,"

On page 3, line 19, delete ", according to claim 3,"

On page 3, lines 24-25, delete "according to claim 4,"

On page 4, lines 4-5, delete "- as already described in connection with claim 1 -"

On page 4, line 12, replace "According to claim 5, the" with -- The --

On page 5, line 1, delete ", according to claim 7,"

On page 5, line 2, delete "also"

On page 5, line 4, replace "According to claim 8, the" with -- The --

On page 5, line 9, replace "According to claim 9, the" with -- The --

On page 5, line 18, replace "Modes for carrying out the invention" with -- Detailed Description of Certain Illustrated Embodiments --

On page 5, line 20, after "device" insert delete -- 10 --

On page 5, line 20, delete "11"

On page 7, line 2, delete "11' " after "periphery"

On page 8, line 8, replace "after" with -- before --

On page 8, line 9, after "19" insert -- after installation --

On page 9, line 6, replace "14.0r" with -- 14.o --

On page 10, line 1, replace "Claims" with – We claim: --

IN THE CLAIMS:

Cancel claim 7.

Amend claims 1 - 6 and 8, 9 as follows:

1. (Once amended) Panel loudspeaker comprising

[with] at least one sound radiating panel having a core layer [13] and at least one cover layer connected with the core layer [14o, 14u],

[with] a periphery [12] that surrounds the [panel loudspeaker 11] at least one sound radiating panel with a lateral gap [A], and

[with] at least one connecting element [elements 17, 17'] that [connect the panel loudspeaker 11] connects the at least one sound radiating panel with the periphery [12], [characterized in that]

wherein the at least one connecting element [elements 17, 17' are] is under mechanical tension when connected with the periphery [12], and

wherein regions of the at least one cover layer that are connected with the core layer are also under mechanical tension.

2. (Once amended) Panel loudspeaker according to claim 1,

[characterized in

that] wherein the at least one connecting [elements 17, 17' are] element is formed by the at least one cover layer [(s) 14o, 14u] of [the] respective [panel loudspeaker 11] sound radiating panel in that at least one of the cover layers [14o, 14u] of the respective sound radiating panel [loudspeaker 11] extends to the periphery [12].

3. (Once amended) Panel loudspeaker according to claim 1 [or claim 2,

characterized in

that], wherein the periphery is formed by a frame [19].

4. (Once amended) Panel loudspeaker according to claim 1 [or claim 2,

characterized in

that], wherein the periphery [12 of a panel loudspeaker 11] is formed by at least one additional panel [10].

5. (Once amended) Panel loudspeaker according to claim 1 [or claim 2,

characterized in

that], wherein the [respective] at least one connecting element [elements 17, 17' are] is provided with a tension [strips 20] strip disposed on [the] a marginal [edges 24"] edge of the at least one sound radiating panel that [are] is connected with the periphery [12],

[that] wherein the periphery has edges [21] that are contacted by the tension [strips 20] strip when the [panel loudspeaker 11] at least one sound radiating panel is connected with the periphery [12], and

[that] wherein for a sound radiating panel [loudspeaker 11] that has not yet been connected with the periphery [12], [the] distances [A'] between [the] a respective tension strip [strips 20] and [the] coordinate lines [x, y] extending through [the] a center of [the] a respective sound radiating panel [loudspeaker 11,] are smaller than [the] distances [A"] between the edges [21] and [the] coordinate lines [x, y] that also extend through [the] a center of the periphery [12].

6. (Once amended) Panel loudspeaker according to [one of the claims 1 to 5,

characterized in

that] claim 1, wherein the sound radiating panel [loudspeaker 11] is a bass panel adapted to reproduce low-frequency sound.

8. (Once amended) Panel loudspeaker according to [one of the claims 1 to 6, characterized in

that] claim 1, wherein at least one of the core layer [13] and[/or] the at least one connecting [elements 17, 17' are] element is provided with a damping element [30].

9. (Once amended) Panel loudspeaker according to claim [7] 8, [characterized in

that] wherein [the] a mechanical tension in the at least one connecting [elements 17, 17'] is different from the mechanical tension in the at least one tensioned cover layer [layers 14o, 14u].

REMARKS

The amendments to the specification reflect certain amendments submitted in the PCT phase by way of replacement sheets.

Claims 1 has been amended to include the subject matter of claim 7 which has been cancelled. Amended claim 1 corresponds to amended PCT claim 1 which forms the basis of the International Preliminary Examination Report. Claims 2-6 and 8-9 have been amended to remove multiple dependency and conform the claims to US practice .

Favorable consideration and allowance are earnestly solicited. Should there be any questions after reviewing this paper, the Examiner is invited to contact the undersigned at 617-832-1000 (direct dial 617-832-1753).

Respectfully submitted,
FOLEY, HOAG & ELIOT LLP

Date: November 9, 2000

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20/430755.1

Panel loudspeaker

Technical field

The invention relates to panel loudspeakers and, more particularly, to improving the radiation characteristic of panel loudspeakers at low frequencies.

State of the art

Panel loudspeakers operating according to the multi-resonance principle are known in the art and frequently referred to as "distributed mode loudspeakers." These devices are essentially formed of a flat panel and at least one drive system, wherein oscillations are introduced in the panel by supplying low frequency electrical audio signals to the drive system. The drive systems for these devices are formed of one or several of electromagnetic drivers (shakers), depending on the application. However, the drive systems can also include piezo-electric bending oscillators, either alone or in combination with the aforedescribed shakers.

To properly operate panel loudspeakers, the loudspeakers are connected to a periphery using connecting elements. With this periphery, the entire panel loudspeaker can be secured from the outside and, on the other hand, the weight of the panel and of the drive system(s) can be supported in a manner advantageous for sound reproduction.

In sound reproduction systems implemented as panel loudspeakers, "bending wave radiation" can occur above a critical lower frequency limit, with the panel loudspeaker radiating the bending waves in a direction that depends on the sound frequency. A cross-section through a directional diagram shows a main lobe having a frequency dependent direction.

The panel of the panel loudspeaker consists of a sandwich structure, wherein preferably two opposing surfaces of a very light core layer are connected, for example by an adhesive bond, by way of a respective cover layer that is thin in

comparison to the core layer. The panel loudspeaker has a particularly good sound reproduction if the material for the cover layer has a high dilatational wave velocity. Suitable material for cover layers are, for example, thin metal foils or fiber-reinforced plastic foils. The core layer also has to meet certain requirements and should have a particularly low density of, for example, 20 to 30 kg/m^3). The core layer should also be able to withstand high shearing forces acting normal to the cover layers, which requires that the elasticity module in the direction normal to the cover layers is sufficiently large, whereas a small elasticity module parallel to the cover layers is acceptable. Accordingly, the core layer can be either anisotropic or isotropic. Suitable ultra-light core layer structures are, for example, honeycomb structures made of light metal alloys or resin-impregnated fiber-reinforced paper (anisotropic) and expanded foam (isotropic).

A system of the aforedescribed type can radiate sound waves by connecting the panel to a drive system which deforms the panel perpendicular to the plane of the cover layers in a wave-like pattern. The drive system can be a conventional magnet system that is attached to or integrated with the panel.

The efficiency of panel loudspeakers operating according to the multi-resonance principle can be optimized by leaving the marginal edge of the panel, if all possible, "unrestrained." In other words, transverse oscillations propagating in the panel should be neither restricted nor attenuated in the marginal region of the panel.

Although the panel loudspeaker described above can successfully reproduce tones in the midrange and high-frequency range, it has been observed that low frequencies, i.e., bass tones, can only be faithfully reproduced by using panels having an undesirably large surface area. If the required large surface area is not provided, then the lowest panel frequencies which support the bass reproduction, move to the mid-frequency range.

It is a therefore an object of the invention to provide panel loudspeakers with relatively small panel surface areas that have an improved sound reproduction in

the bass frequency range.

Description of the invention

The object is solved by the characterizing features of claim 1. Advantageous embodiments and improvements are recited in the claims 2 to 9.

If a panel of a panel loudspeaker is connected with a periphery by way of connecting elements that are under mechanical tension, then additional resonances, in particular low frequency drum resonances, are produced in addition to the existing low frequency panel resonances. These additional resonances can be tuned by adjusting the tension in the connecting elements.

It should be pointed out at this point that the material used for the connecting elements and the pretension in the connecting elements has a significant impact on the reproduction of low-frequency audio signals.

It is not necessary that the tensioned connecting elements have the same tension in different directions.

If, according to claim 2, the respective connecting elements are formed either by one cover layer or by both cover layers, with the respective cover layer(s) bridging the lateral gap to the periphery, then the periphery and the panel form a very simple unit that can be manufactured easily and inexpensively.

If, according to claim 3, the respective periphery is formed by a frame, then such assemblies can be easily connected with other objects, because the required tension in the cover layer(s) and/or the connecting elements can be produced with high quality already at the place of manufacture.

The panel loudspeakers according to the invention can not only be used as stand-alone sound reproduction units. Instead or in addition, according to claim 4, several panel loudspeakers can also be combined into a larger acoustic wall, without the need to directly connect the individual panel with a periphery that is not excited by drivers. It has been observed in the context of the present

invention that the same type of connecting elements that are employed to connect the panel to a periphery that is not excited (e.g., a frame), can also be used to connect adjacent panels of a larger acoustic wall with one another, without acoustically coupling these panels. If such larger acoustic wall - as already described in connection with claim 1 - is also connected, for example, with a frame through corresponding connecting elements, then the tension that exists in the connecting elements attached to the frame can also be used to adjust the tension in the connecting elements that are disposed between the panels of the acoustic wall. The tension in the connection between two adjacent decoupled panels can then be fine-tuned by selecting a proper size and/or material for the respective connecting element.

According to claim 5, the tension in the cover layers and/or connecting elements can be easily adjusted by providing tensioning strips on the edges of the corresponding connecting elements that are connected with the periphery. The tension can further be adjusted by providing the periphery with edges which are in contact with the tensioning strips when the panel is connected to the periphery, and by making the distance between the tensioning strips and the coordinate lines extending through the center of the respective panel loudspeaker smaller than the distance between the edges and the coordinate lines that also extend through the center of the periphery, before the panel is connected to the periphery. By connecting the tensioning strips with the edges, a uniform tension defined by the respective distances can be easily attained in the cover layers and the connecting elements of the respective panel loudspeaker.

The connecting elements under tension provide particularly advantageous sound reproduction conditions with a panel loudspeaker formed in this manner and used for reproducing low-frequency audio signals. However, the application of pretensioned connecting elements is not limited to improving only the bass reproduction. Cover layers and/or connecting elements under tension can also be employed with midrange and broadband panels.

If, according to claim 7, the regions of the cover layers that are connected with the core layer are also under mechanical tension, then the dilatational wave velocity of the cover layers is increased, in particular when using thin metal foils.

According to claim 8, the oscillation amplitude of the very low-frequency resonances produced by the mechanical tension of the connecting elements and/or the cover layers can be reduced by providing those elements that are subject to mechanical tension (cover layers and/or connecting elements) with attenuation (damping) elements to provide damping.

According to claim 9, the mechanical tension in the connecting elements and the cover layers can be different. In this way, different attenuation values can be easily realized for the different elements.

Brief description of the drawings

Fig. 1 shows a top view of a panel loudspeaker;

Fig. 2 shows a top view of another panel loudspeaker;

Fig. 3 is a side view of the panel loudspeaker of Fig. 1;

Fig. 4a, b show another side view of a panel loudspeaker; and

Fig. 5a, b show another side view of a panel loudspeaker.

Modes for carrying out the invention

The invention will now be described in detail with reference to the Figures. Fig. 1 shows a sound reproduction device in form of a panel loudspeaker 11 operating according to the aforedescribed "bending wave principle." The sound reproduction device 10 is formed by a panel 11 and a periphery 12.

As seen in more detail in Fig. 3, the panel 11 is constructed as a sandwich structure which includes a core layer 13, which in the present example has a honeycomb structure, and thin cover layers 14.o, 14.u disposed on two opposing

surfaces of the core layer 13.

In the embodiment depicted in Fig. 1, the periphery 12 is formed by an installation wall with an opening 15. The panel 11 is inserted into this opening. The connection between the panel 11 and the periphery 12 formed by the installation wall 16 is implemented by connecting a connecting element 17 with the cover layers 14.o and the installation wall 16. As seen from Fig. 1, which depicts a top view of a panel loudspeaker 10, the connecting element 17 is formed as a single piece and completely covers the gap A formed between the opposing edges 24 and 24' of the panel 11 and the respective opening 15.

Excellent sound reproduction is achieved by placing the cover layers 14.o, 14.u of the panel 11 under mechanical tension. The tension in the connecting elements 17 which is indicated in Fig. 3 by the double arrow P, is achieved in the embodiment illustrated in Fig. 1 by stretching the regions of the connecting element 17 that are in contact with the installation wall 16, in the x- and y-direction (Fig. 1) after the panel 11 is inserted in the opening 15, but before these regions are connected with the installation wall 16.

For sake of completeness, it should be mentioned with reference to Figs. 1 and 3, that the reference numeral 18 in Fig. 1 indicates drivers that introduce oscillations in the panel 11, and that the connecting element 17" indicated in Fig. 3 by the dashed line can provide another connection - which is also under tension - between the installation wall 16 and the panel 11.

As indicated in Fig. 3 by the dotted double arrows P4, the cover layers 14.u, 14.o that are connected with the core layer 13 can also be under mechanical tension. However, the degree of the mechanical tension of the connecting elements 17 and the cover layers 14.u, 14.o need in this case not be identical. The reference numerals 30 in Fig. 3 indicate optional damping element s for limiting the oscillation amplitude when the connecting elements 17,17' and/or the cover layers 14.o, 14.u are under mechanical tension.

Fig. 2 shows a panel loudspeaker 10 consisting of several panels 11. The panels 11" surrounding the panel 11' form the periphery 11' of the panel 11' with respect to the center panel 11'. In the illustrated embodiment, a separate frame that surrounds all panels 11 forms the periphery 12 for all panels. Using a separate frame 19 with one or several panels 11 has the advantage that the connecting elements 17 do not have to be tensioned when the panel(s) is/are connected at the installation location, but that the tension in the connecting elements 17 can be adjusted easily and exactly already at the factory, if the respective panel loudspeaker(s) is/are shipped installed in a frame 19.

As also seen from the top view of Fig. 2, the panels 11 can have different dimensions as well as a different spacing from one another and/or from the frame 19. The panels 11 have different dimensions because the different panels 11 of the device illustrated in Fig. 2 are so-called range radiators optimized for different audio frequency ranges. For decoupling the different panels 11 from each other, the spacing between the individual panels 11 and/or the spacing between the panels 11 and the frame 19 is also adapted to the respective reproduction range of these panels 11. Since the panels 11 are optimized for different frequency ranges, the mechanical tension in the cover layers (not shown in detail in Fig. 2) of the different panels 11 can also be adapted to the different reproduction requirements.

In the embodiment depicted in Fig. 2, separate connecting elements 17 are no longer required. Instead, the panels 11 are connected with each other and/or with the frame 19 only through the cover layer 14.o. This type of connection is shown in detail in Figs. 4b and 5b and will be discussed below more specifically with reference to these Figures.

Fig. 4a depicts an embodiment of a frame 19. A panel 11 is arranged above the frame 19. Unlike the panel 11 shown in Fig. 3, the cover layer projects slightly over the marginal edges 24 of the core layer 13. In addition, tension strips 20 are attached to the marginal edges 24" of the cover layer 14.o. If the cover layer

14.o is elastically deformed by an external force in the direction of the arrow P1 and is in this state lowered towards the frame 19 in the direction P2, then the situation shown in Fig. 4b will arise where the cover layer 14.o contacts the frame. As also seen in Fig. 4b, the panel 11 is connected to the frame 19 only through the cover layer 14.o and the tension strips 20 contact the lateral edges 21 of the frame at the end of the aforedescribed movement in the direction of the arrow P2. Since according to the situation illustrated in Fig. 4a, the separation A' between the two tension strips 20 after installation is smaller than the separation A" between two opposing marginal edges 21 of the frame 19, the desired mechanical tension (as indicated by the double arrows) builds up in the situation depicted in Fig. 4b as a result of the restoring forces produced in the regions 17' of the cover layer 14.o.

If, unlike the illustration of Figs. 4a and 4b, the cover layer 14.o is not connected with the core layer 13, then tension builds up in the entire cover layer 14.o. To maintain the advantageous effects of the tension cover layer 14.o for sound transmission, the core layer 13 will have to be connected with the cover layer 14.o.

Figs. 5a and 5b depict another embodiment of a connection under mechanical tension between a panel 11 and a frame 19. Unlike the embodiment depicted in Figs. 4a and 4b, the spacing A' between the tension strips 20 is identical to the spacing A" between the opposing marginal edges 21 of the frame 19. With these values for the respective spacing, the cover layer 14.o depicted in Fig. 5a need not be exposed to a force (P1) (shown in Fig. 4a) in order to establish a connection with a frame 19 (Fig. 5b). The required tension in the regions 17' of the cover layer 14.o is produced by first establishing contact between the cover layer 14.o and the frame 19 as well as between the tension strips 20 and the marginal edges 21 without tension (a shown on the left side in Fig. 5b), and by subsequently rotating one or both tension strips 20 in the direction of arrow P3. As a result, the narrow side 23 of the tension strips 20 - instead of the longer side 22 - makes contact with the marginal edge 21 of the frame 19 (a shown on the

right side in Fig. 5b).

If tension is to be introduced not only in the regions 17' of the cover layer 14.o, but rather across the entire cover layer 14.o, then the cover layer 14.o should be connected to the frame 19 following the discussion above with reference to Figs. 4a to 5b, whereafter the core layer 13 is attached to the fully tensioned cover layer 14.0, for example, with an adhesive. If the entire cover layer 14.o is under tension, then the core layer 13 and the cover layer 14.o need not be connected in a subsequent separate operation as long as the unit composed of the core layer 13 and the cover layer 14.o is connected according to Figs. 4a to 5b and the adhesive connecting the cover layer 14.o with the core layer 13 has not yet set.

For sake of completeness, it should be noted that the embodiments depicted in Figs. 4a to 5b can be modified so as to place both cover layers 14.o and 14.u under mechanical tension.

New claims

1. Panel loudspeaker

with a core layer (13) and at least one cover layer (14o, 14u),

with a periphery (12) that surrounds the panel loudspeaker (11) with a lateral gap (A), and

with connecting elements (17, 17') that connect the panel loudspeaker (11) with the periphery (12),

wherein the connecting elements (17, 17') are under mechanical tension when connected with the periphery (12),

characterized in

that also the regions of the cover layers (14o, 14u) that are connected with the core layer (13) are under mechanical tension.

2. Panel loudspeaker according to claim 1,

characterized in

that the connecting elements (17, 17') are formed by the cover layer(s) (14o, 14u) of the respective panel loudspeaker (11) in that at least one of the cover layers (14o, 14u) of the respective panel loudspeaker (11) extends to the periphery (12).

3. Panel loudspeaker according to claim 1 or claim 2,

characterized in

that the periphery is formed by a frame (19).

4. Panel loudspeaker according to claim 1 or claim 2,

characterized in

that the periphery (12) of a panel loudspeaker (11) is formed by at least one additional panel (10).

5. Panel loudspeaker according to claim 1 or claim 2,

characterized in

that the respective connecting elements (17, 17') are provided with tension strips (20) on the marginal edges (24") that are connected with the periphery (12),

that the periphery has edges (21) that are contacted by the tension strips (20) when the panel loudspeaker (11) is connected with the periphery (12), and

that for a panel loudspeaker (11) that has not yet been connected with the periphery (12), the distances (A') between the tension strips (20) and the coordinate lines (x, y) extending through the center of the respective panel loudspeaker (11), are smaller than the distances (A") between the edges (21) and the coordinate lines (x, y) that also extend through the center of the periphery (12).

6. Panel loudspeaker according to one of the claims 1 to 5,

characterized in

that the panel loudspeaker (11) is a bass panel adapted to reproduce low-frequency sound.

7. Panel loudspeaker according to claim 1 or claim 6,

characterized in

that the core layer (13) and/or the connecting elements (17, 17') are provided with damping elements (30).

8. Panel loudspeaker according to claim 7,

characterized in

that the mechanical tension in the connecting elements (17, 17') is different from the mechanical tension in the tensioned cover layers (14o, 14u).

pan 0220 S

Customer Number 25181
Docket No: HAS-008.01

COMBINED DECLARATION FOR PATENT APPLICATION

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and joint inventor of the subject matter which is claimed and for which a patent is sought on the invention entitled:

PANEL LOUDSPEAKER

the specification of which (check one)

(X) is attached hereto.
( ) was filed on , as United States Application Number or PCT International Application Number , and was amended on _____ (if applicable).

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulation, § 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, § 119(a)-(d) of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed.

Prior Foreign Application(s)			Priority Claimed
PCT/EP99/03312 (Number)	PCT (Country)	May 14, 1999 (Day/Month/Year Filed)	(x) Yes ( ) No
DE 198 21 855.9 (Number)	Germany (Country)	May 15, 1998 (Day/Month/Year Filed)	(x) Yes ( ) No

I hereby claim the benefit under Title 35, United States Code, § 119(e) of any United States Provisional application(s) listed below.

_____ (Application Number) (Filing Date)

_____ (Application Number) _____ (Filing Date)

I hereby claim the benefit under Title 35, United States Code, § 120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, § 112, I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, § 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application.

_____ (Application Number)	_____ (Filing Date)	_____ (Status - patented, pending, abandoned)
_____ (Application Number)	_____ (Filing Date)	_____ (Status - patented, pending, abandoned)

I hereby appoint Beth E. Arnold, Reg. No. 35,430; Isabelle Clauss, Reg. No. 47,326, Kirk Damman, Reg. No. 42,461; Stephen B. Deutsch, Reg. No. P-46,663; Jason Gish, Reg. No. 42,581; Dana M. Gordon, Reg. No.44,719; Robert A. Greenberg, Reg. No. 44,133; David Halstead, Reg. No. 44,735; Edward J. Kelly, Reg. No. 38,936; David A. Lane, Jr., Reg. No 39,261; W. Hugo Liepmann, Reg. No. 20,407, Robert Mazzarese, Reg. No. 42,852; James T. Olesen, Reg. No. P-48,172; Kevin A. Oliver, Reg No. 42,049, Chinh H. Pham, Reg No. 39,329; Wolfgang E. Stutius, Reg. No. 40,256, Kingsley L. Taft, Reg. No. 43,946, Anita Varma, Reg. No. 43,221; Matthew P. Vincent, Reg. No. 36,709; Sharon Webb, Reg. No. P-46, 967; and John L. Welch, Reg. No. 28,129 as attorneys to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith.

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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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